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CENTRAL INTELLIGENCE AGENCY
WASHINGTON, D.C. 20505

CIA/OER/S-06287-74

3 July 1974

MEMORANDUM FOR: Mr. J.D. Darroch
Council of Economic Advisers
Old Executive Office Building

SUBJECT : Estimates of US Import Demand Elasticities for Iron and Steel

The attached report is in response to your request of 13 June for information on CIA and other estimates of US import demand elasticities for iron and steel products.

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I [redacted] will be happy to answer any additional questions you might have on this subject.

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Attachment:
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Estimates of US Import Demand Elasticities for Iron and Steel

Relatively little theoretical or empirical work exists on commodity-specific import demand equations. Most researchers who have estimated such equations have used some variant of the simple log linear demand function in which the independent variables typically are the ratio of the prices of imported and competitive domestic goods, and one or more domestic activity terms:

$$\log M = a + b \log (PM/PD) + c \log Y + e$$

where: M is the import volume index for the commodity group

PM is the import price index for the commodity group

PD is the domestic price index for the commodity group

Y is real gross national product of other activity term

e is the error term

b is the estimated relative price elasticity

c is the estimated income elasticity.

C.R. MacPhee[1] estimates an equation of this type for US steel imports for the 1963I to 1968IV period:

$$\log M = \underset{(0.139)}{-.0493} - \underset{(0.979)}{4.170} \cdot \log (PM/PD) + \underset{(0.559)}{2.307} \cdot \log Y +$$

$$\underset{(0.289)}{.095} \cdot \log (X_1) + \underset{(0.063)}{.176} \cdot (X_2) - \underset{(.426)}{.243} (X_3) \qquad R = .977 \quad DW = 1.73$$

where: X_1 is an index of capacity utilization in the US iron and steel industry

X_2 is a binary dummy variable = 1 in periods of significant strike activity in the US steel industry = 0 in other quarters

X_3 is the percent of US water transport and longshore workers on strike.

(The numbers in parentheses are the standard errors)

The price coefficient is quite large and is statistically significant. The capacity utilization and dock strike variables were not significant, but the steel strike variable was. MacPhee uses these estimates to help guage the restrictiveness of non-tariff barriers on iron and steel trade.

Price and Thornblade[2] have estimated a similar equation, but distinguish between US demand for imports from different countries and between various steel products. Their equation is:

$$\log M_j = a + b_1 \cdot \log \sum_{\theta=0}^{2} \alpha_\theta \frac{PM_{t-\theta}}{PD_{t-\theta-1}} + b_2 \cdot \log \sum_{\pi=0}^{2} \alpha_\pi \cdot \frac{PM_{t-\pi}}{POM_{t-\pi-1}} + c \log Y_{t-1} + d_1 Q_2 + d_2 Q_3 + d_3 Q_4$$

where: the second and third terms use a three-quarter weighted moving average where the weights are:

$\alpha_0 = 1/2$ $\alpha_1 = 1/3$ $\alpha_2 = 1/6$

POM is the composite price index for steel imports from countries other than country j.

Y is domestic steel production.

Q_2, Q_3, Q_4 are seasonal dummy variables where Q_i has a value of one in the i^{th} quarter of the year and zero otherwise.

Table 1 shows that Price and Thornblade had varying degrees of success with their country and commodity specific import demand

Table 1

US Import Demand in Major Categories of Steel Products from Leading Foreign Suppliers

(values in parentheses are t values)

	$\frac{P_M}{P_D}$	$\frac{P_M}{P_{OM}}$	Domestic Production	Con-stant	Q_2	Q_3	Q_4	R^2	Standard Error of Estimate
Iron & Steel Sheets, Plates (SITC 674)									
Japan	-8.354 (-5.228)	0.384 (.260)	0.869 (1.620)	15.965	0.095 (1.320)	0.089 (1.170)	0.061 (.947)	.726	0.105
West Germany	-10.755 (-4.116)	11.142 (3.743)	.845 (-.827)	-1.269	0.308 (2.260)	0.446 (3.156)	0.482 (4.052)	.748	0.195
United Kingdom	-3.183 (-0.835)	1.739 (0.369)	1.956 (1.383)	-9.160	0.371 (1.964)	0.445 (2.243)	0.428 (2.488)	.550	0.274
Canada	-7.177 (-2.106)	1.674 (1.058)	1.776 (2.599)	1.200	-0.009 (-0.094)	-0.066 (-0.657)	-0.076 (-0.926)	.469	0.133
Iron & Steel Bars (SITC 673)									
Japan	-1.902 (-0.938)	-0.121 (-0.131)	1.047 (1.859)	5.543	0.101 (1.857)	0.055 (0.843)	0.066 (1.279)	0.515	0.080
Belgium	-0.576 (-0.348)	-2.100 (-0.677)	1.638 (2.696)	2.934	0.162 (2.809)	0.058 (0.851)	0.042 (0.784)	.665	0.085
France	-3.591 (-1.929)	5.401 (1.477)	1.412 (1.575)	-4.957	0.176 (1.997)	0.050 (0.479)	0.025 (0.301)	.519	0.130

Table 1 - cont'd

	$\frac{P_M}{P_D}$	$\frac{P_M}{P_{OM}}$	Domestic Production	Constant	Q_2	Q_3	Q_4	R^2	Standard Error of Estimate
West Germany	-3.009 (-1.249)	-1.299 (-0.333)	0.515 (0.518)	13.410	0.281 (2.864)	0.224 (1.899)	0.254 (2.770)	.601	0.145
United Kingdom	-4.669 (-2.195)	1.442 (0.645)	-0.414 (-0.424)	17.110	0.219 (2.294)	0.319 (2.802)	0.227 (2.542)	.722	0.141
Iron & Steel Tubes, Pipes (SITC 678)									
Japan	-3.567 (-2.798)	0.139 (0.260)	0.255 (0.468)	13.374	0.102 (1.539)	0.084 (0.876)	0.078 (1.247)	0.713	0.073
Canada	8.269 (1.258)	0.418 (0.098)	1.900 (1.053)	-22.365	-0.247 (-1.141)	-0.435 (-1.401)	-0.247 (-1.192)	.748	0.223

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estimates. The relative price elasticity between domestic and foreign supply has the expected negative sign in 10 out of 11 cases, but is significantly different from 0 (at the 95% confidence level) in only 5 out of 11 cases. The relative price elasticity between foreign suppliers has the expected negative sign in only 3 out of 11 cases.

Kreinin,[3,4] using the same general specification, found no significant price effect on US aggregate demand for imported iron and steel products. Similarly, Officer and Hurtubise[5] -- using a somewhat different framework -- report that the relative price term was insignificant in their equation representing US demand for Canadian iron and steel.

The studies mentioned share a number of significant weaknesses:

- In each case, unit values were used to construct import price indexes. There is considerable concern that unit values -- while easy to acquire -- are not an accurate price measure.

- There is substantial evidence that institutional factors, such as strikes, non-tariff barriers, and cyclical swings, have a significant impact on trade in steel, but most of the studies ignore these factors. None of them accounts for the institution of the VRA.

- No experimentation was made with alternate functional forms.

A major part of the CIA Trade-Flow Model Project consists of the estimation of country and commodity-specific import demand equations for the United States, and for 12 other counties, for iron and steel products. CIA employs a sophisticated n-level procedure, which first estimates the elasticity of substitution between domestic and foreign steel, and then the elasticity of substitution between foreign sources of supply. We are currently experimenting with several different functional forms, and we expect to include a considerable amount of institutional data. We have so far estimated only the second stage of the demand relationship, the elasticity of substitution between various foreign suppliers of iron and steel in the US market. Some preliminary results are presented in Table 2.[6]

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Table 2

Estimates of the Elasticity of Substitution Between Foreign Steel Suppliers in the US Market

1. Unconstrained dynamic import demand Equations, estimated by OLS (elasticity of substitution between French and German steel in the US market).

Type of Lag	Θ	$\hat{\sigma}$	R^2
Almon Second Order	3	1.57	.60
	4	1.61	.65
	5	2.31	.66
Almon Third Order	3	2.34	.75
	4	2.81	.69
	5	3.40	.66
Free Lag	3	2.57	.74
	4	3.19	.72
	5	1.24	.73

2. Static import demand system constrained to be equal between foreign suppliers, estimated by OLS.

$\hat{\sigma} = 1.64$ $t = 6.96$

3. Import demand equation estimated by full information maximum likelihood technique (elasticity of substitution between Japanese, Canadian, Benelux, German, and UK steel in the US market).

$\hat{\sigma} = 1.38$ $t = 2.18$ Individual equation R^2's range from .48 to .94

4. Brown-Heien import demand equations estimated by the full information maximum likelihood technique (elasticity of substitution between Japanese, Canadian, German, and Benelux steel in the US market).

$\hat{\sigma} = 2.3$ $t = 1.16$ System $R^2 = .91$

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1. C.R. MacPhee, Non-Tariff Barriers to International Trade in Steel, University Microfilms #71-2112, Ann Arbor, Michigan.

2. James E. Price and James B. Thornblade, "US Import Demand Functions Disaggregated by Country and Commodity," Southern Economic Journal, July 1972.

3. Mordecai E. Kreinin, "Disaggregated Import Demand Functions - Further Results," Southern Economic Journal, July 1973.

4. GATT, A Survey of Possible Approaches to a Study of Trade Effects of Tariff Changes, June, 1972.

5. Lawrence Officer and James Hurtubise, "Price Effects of the Kennedy Round on Canadian Trade," Review of Economic and Statistics, August 1969.

6. CIA Trade-Flow Model, IPA Report, January 1974.

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